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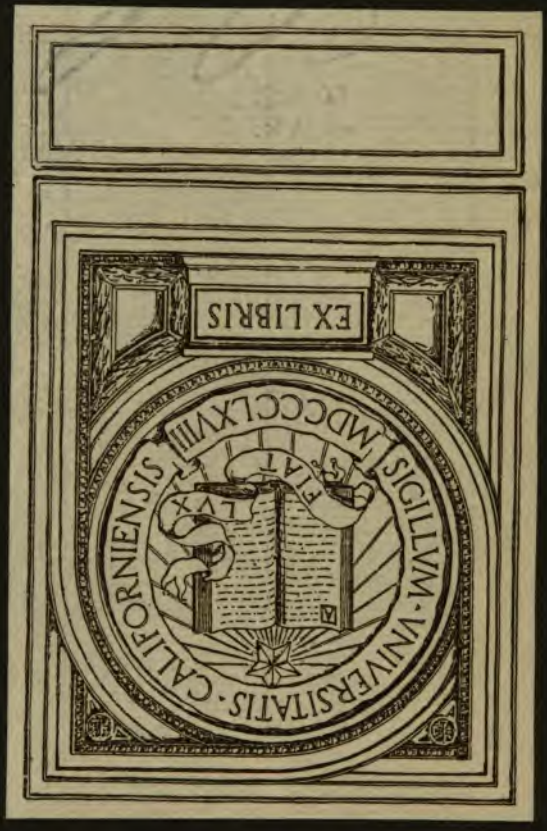

FLIES AND MOSQUITOES AS CARRIERS OF DISEASE

BY

WM. PAUL GERHARD, C. E.

What Farmers Can Do to Assist in the Campaign Against Flies and Mosquitoes

BY

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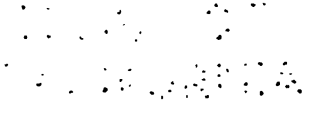

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Flies and Mosquitoes as Carriers of Disease

By
William Paul Gerhard

It is now well known that the common house fly and the mosquito are not merely nuisances but enemies to mankind and positive dangers to health by becoming at times the medium for disseminating disease germs. We hear much of flies being the indirect cause of typhoid fever, and of some species of mosquitoes causing malarial fever. Both typhoid fever and malaria, though occurring to some extent in cities, are considered to be chiefly *country* or *farm diseases;* hence this subject ought to interest the farmer.

It is not necessary for our purposes to explain at length how diseases are transmitted by insects. Suffice it to mention that some insects, like flies, carry disease mechanically by transferring the germs by means of their bodies, wings and feet from human excreta to our food, while others, like some species of mosquitoes, become the host of disease germs, with which they inoculate human beings through their bite. It is now firmly asserted that one species of the mosquito, the *anopheles,* is the *only contributing cause of malaria,* and that this illness may be entirely avoided by preventing persons from being bitten by infected mosquitoes of this species.

Taking the above statements as a basis, we wish to point out that on many farms, in farmers' houses and about their barns, flies abound in warm weather, while in other country localities the life of the occupants of farm cottages is rendered miserable by the ravages of mosquitoes. While both flies and mosquitoes are bad enough at certain times in the city, they constitute in agricultural districts a veritable pest, a source of annoyance to horses, cattle and men, a cause of physical discomfort, such as loss of sleep, and a nuisance whereby health may become seriously affected. Let us see, then, how far in rural districts the evil can be controlled, and inquire what the farmer can do to assist in the crusade aiming at their extermination. Let us study what conditions are met with in the country and on the average farm, which favor the existence and breeding of both flies and mosquitoes. Let us explain what remedial measures can be readily applied by the farmer who anxiously seeks for improved surroundings.

Flies.

The investigations of entomologists have shown that the "malevolent house fly," as Dr. Felt aptly calls it, breeds principally in horse manure,

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and to a much smaller extent in cow dung; that flies are not frequently found in chicken pens, but that they will lay their eggs in accumulations of human excreta, and in garbage, decaying vegetation and filthy refuse. This accounts for the well-observed fact that flies are specially abundant in the neighborhood of stables and of privy outhouses, and that dwelling houses located close to these are usually badly infested, unless they are protected as described further on. An indirect proof is afforded by the fact that in cities the rapidly increasing use of motor vehicles and the corresponding reduction in the number of stable pits reduces the fly nuisance.

In poor farmers' houses, a dirty condition of rooms, walls and ceilings favors the invasion by flies. Crumbs left on the table and food particles scattered on ill-swept floors or hidden in crevices attract them, as does of course any food which is openly exposed. Filthy cuspidors are another fruitful cause for flies. A high temperature of a room invites the presence of flies; hence they select the kitchen by preference, but also the adjoining dining room, and those bedrooms through or near which the kitchen chimney passes. It is likewise found that dark rooms are less affected than sunny rooms, and rooms on the ground floor more than those on upper floors.

The antiquated and most primitive methods of waste disposal still existing on many farms offer favorable conditions for the breeding and rapid multiplication of flies; neglected privy vaults and unclean privy boxes, or dilapidated outhouses, stable and barn manure pits, offensive overflows from cesspools into open ditches, and similar accumulations of filth and nuisances are potent factors causing the presence of house flies in large numbers.

A mistaken view, altogether too prevalent in many farmers' homes, is that "flies are a necessary evil," which is confined to a few summer months, or that they are an altogether harmless nuisance. Just because the fly nuisance exists only in summer and autumn time, it hardly seems worth while to the farmer to take much trouble to fight it! It is time that farmers should be impressed with the fact that where flies have access to disease-infected discharges *they may carry deadly germs,* and that where they enter the kitchen, the pantry or the dining room, attracted by the food, they deposit the germs in crawling over the food, which they contaminate either in this way or by the fly specks. That the latter may be a source of actual and positive danger will become apparent when we consider that any germ-infected material eaten by flies may pass through their intestinal canal alive, and when deposited on food may spread disease.

Control and Extermination of Flies.

The farmer should resolve not to tolerate such a nuisance and the danger to health incident to it, and should apply himself with energy to the individual work aiming at the control and extermination of flies.

First of all, he should adopt better methods of waste disposal and exercise watchful care over the excreta. To accomplish a proper disposal of sewage matters and of human excreta as well as animal manure in such

a manner that they cannot become accessible to flies is indeed one of the important problems which in the country confront the modern sanitarian.

The installation of indoor plumbing conveniences, including water-closets, is one step in the right direction, and the tendency has in recent years been to take seriously the advice of sanitary engineers that sanitary plumbing should be introduced into farmhouses. But if outdoor conveniences must be adhered to, let these consist of properly maintained earth closets, the contents of the boxes being covered with lime or other disinfectant every few days, and the boxes being removed and changed frequently. And if, perchance, it should be necessary to retain a privy vault, be sure to have its contents frequently disinfected by sprinkling with carbolic acid, or with chemical compounds like lysol or saprol. Cesspools should receive a similar treatment, and Dr. L. O. Howard mentions the use, originating in France, of residuum oil in privies and cesspools, by which fly larvæ are killed, the flies prevented from entering, and the eggs already laid destroyed before hatching.

Where there is sewerage, see to it that it is in proper working order, that no stoppages and no leaks in the drains exist.

From what has been said so far, and also from what follows, it will be apparent that the extermination of flies can be brought about chiefly by a diligent attention to a proper disposal of waste matter, and by the maintenance of scrupulous cleanliness. Hence, *the fly problem is a sanitary problem,* and it is for this reason that we find it in recent years occupying the serious attention of sanitarians.

The next points to which the farmer should pay attention are his horse stables, cow barns, and manure pits. The farm boss should instruct his farm hands and the hired help regarding the proper care of these. It is desirable that horse stalls should have water tight floors, and in any case it is necessary to construct the manure pits in cement and concrete so as to be tight, and to have them well covered. All rain water should be excluded from them, and their construction should be such as to prevent flies from entering. The screening of manure pits has been suggested to prevent flies from breeding in them, but where the pits are occasionally treated with chloride of lime, wire screens will rapidly corrode. This treatment is said to be cheaper and more effective than the occasional sprinkling of the manure pit with kerosene oil, although this latter method doubtless also effects some improvement. Hence, it is better to cover manure pits up and to keep them dark to prevent the flies from breeding in the manure. It is quite important to prevent the pits from becoming filled up by having the manure hauled away at least twice a week and spread on the land. ✱ ⊙

Dairy farmers should look particularly to the sanitation of the milk house and abolish privy vaults, outhouses, cesspools or manure pits existing in their neighborhood. The contamination of the milk supply by flies may be prevented by screening the dairy windows and doors, which renders such a building practically flyproof.

Barnyards should be kept scrupulously neat and tidy; gutters and stalls of stables should be cleaned daily, all refuse heaps kept covered

⊙ See also page 14

✱ According to Dr. Chas. Wardell Stiles, Public Health Officer of Washington, D. C., "Privies should be screened with perfect screens, and the seats should be kept clean."

pending removal, no decaying organic material permitted to accumulate on the premises, and, not least in importance, the household garbage can should be cleaned and scoured daily, and when in use be always kept well covered. Garbage should be stored in metal receptacles with metal tight-fitting covers, and all filth-reeking wooden garbage boxes or leaky slop pails abolished. Do not permit the women of the household to dispose of kitchen slop water, in cases where there is no kitchen plumbing, by throwing it, day by day, over the same spot near the kitchen door, for the spot will become offensive and necessarily will attract insects.

Coming to remedies to be applied inside the farmer's house, it should be pointed out that there is no serious or real difficulty in dealing successfully with the plague of flies, which exists in many places. "The great secret of how to get rid of flies is minute cleanliness in everything."

The up-to-date farmer screens all his windows and outside doors to *keep out the insects,* but there are still countless unscreened farmhouses to which flies have free access. Of greatest importance are, of course, the places where the food is kept, prepared, or eaten, in other words, the pantry, the kitchen and the dining room.

The protection which well-made and well-kept window and door screens afford, while of much value during the summer months, is perhaps of the greatest importance during the fall, when the first cool days appear, with their tendency to drive the flies indoors. Surely it would seem as if it were more than a mere coincidence that this is also the season of the year when typhoid fever is of most frequent occurrence.

It is advisable to screen also all food stored in the vegetable or fruit cellar, and especially to protect such foods as do not require cooking, like salads, celery, fruit, milk, etc.

The subject of screening houses will be once more referred to under the heading of mosquito control.

Where a farmer, after having attended to the stable manure pits and privy vaults, whence the vast majority of flies come, still finds them trying to enter the house, he should remember that their presence is always a positive indication of the existence of some form of filth in or near the premises. Hence he should institute a special inspection and search for other breeding places about or around the house, and when he finds them, he should forthwith set about to destroy them. If there are neighbors not far away, he should induce them to coöperate by having them keep their premises and yards clean and burn up all rubbish. He should impress them with the fact, and always himself bear in mind, that *filth and food are the two principal attractions for flies,* and that their passage from the first to the second must be prevented at all hazards, if one wishes to avoid disease.

After the meals all food remnants should be carefully removed and covered up or burnt. Where cuspidors are used in houses, they should be kept scrupulously clean, scoured daily with hot water and soap, and disinfected from time to time.

The farmer should protest against the open exposure of food at the country store where he buys his supplies, and also keep a watchful eye for flies in the country butcher shop and on the itinerant butcher's meat wagon.

If any person in the farmer's family is ill, pains should be taken to exclude flies from the sick room. The patient should be protected by a net to keep the flies from him, or else the sick room should be screened, while flies which have gained access should be removed, caught or killed. If it should prove to be a case of typhoid fever, be sure to have the infected fæces well disinfected, and do not deposit them without such precaution in an open privy vault, for in this way the latter may become a serious menace to health.

Flies in rooms can be killed, or at least their number vastly reduced, by the use of fly paper, either of the sticky or "tanglefoot" kind, or of chemical papers saturated with a poisonous solution; mechanical traps and other devices are also sold, which accomplish much good. A simple remedy, first suggested by a Paris scientist and subsequently endorsed and given a wide circulation by the *London Lancet,* consists in putting formaldehyde, diluted in water in the proportion of two teaspoonfuls to one pint, in a shallow dish of water. This solution is said to destroy numberless flies. The burning of pyrethrum or insect powder, or the simple distribution of the powder in the room by a sprayer, will also kill many of the insects. It is said that flies abhor the odor of oil of lavender, and that putting some of this oil on a cloth and rubbing the window sills and the sides of window frames with it will drive flies away. Others advise keeping a bunch or bag of sweet clover near the window. Some other household remedies are also available, and in cases where farmhouses are badly infested with flies it is almost criminal negligence not to make some efforts in one or the other of the directions given to exterminate the insects.

* * * * * *

Having in the preceding dealt with the fly nuisance and with the methods to be pursued by farmers in the battle against flies, we shall now devote some attention to mosquito control and extermination.

Mosquitoes.

It is said that there are over 200 different species of this insect, and, according to Dr. Felt, there are over fifty known species in this state alone. For our purposes this is not really material, because in instituting practical measures for the extermination of the mosquito it is not required to distinguish between the different kinds. But it should be mentioned that while the ordinary or domestic mosquito makes itself annoyingly felt only through its bite, there are two species which are to be more dreaded because they are instrumental in the spread of disease. Mosquito-borne infection concerns principally two kinds of disease, namely, malaria and yellow fever. The *anopheles* mosquito is now almost universally recognized to be the indirect cause of the transmission of malaria, and the yellow fever mosquito or *Stegomyia callopus* of the southern states and of tropical countries is said to be, according to recent investigations of scientists, the only carrier of yellow fever germs.

It should perhaps be mentioned that there are still some opponents to the "mosquito theory" of the transmission of these and of some other bacterial diseases, but their non-belief is usually restricted to the view that

a particular species of mosquitoes could not be the sole medium of transmission, and that in time to come science will determine other now quite obscure causes.

Malaria was formerly supposed to be due to bad air, to deadly night air, and to miasmas arising from bad drainage, or from a damp subsoil under houses, or from newly upturned soil. But here it may be well to point out that nearly all these alleged causes of malaria are usually associated with the existence of pools of stagnant water, or with swamps, which, as entomologists have ascertained, are the very breeding places for the *anopheles* mosquito.

If the modern mosquito theory is correct, a person suffering from malarial fever, if bitten by a mosquito, may infect the insect and in this way the latter may by its bite convey the disease germ into the blood of other persons. Hence it is important to protect all malaria patients from being bitten—and this applies also to yellow fever patients. Where cases of these two diseases are known to exist, it is imperative that the respective species of mosquitoes be protected from becoming infected, for unless they have become inoculated with the germs of disease, the mosquitoes cannot convey it to persons.

In the coast regions of tropical and sub-tropical countries, and in some of our southern states, the special mosquito named before, an insect with striped wings, causes by its bite the transmission of yellow fever. According to an article by A. Dastre in the *Revue des Deux Mondes* of Paris, which appeared in September, 1905, the yellow fever mosquito can live only under conditions of high temperature, and dies when the air is cooler than sixty degrees. The insect bites with energy only when the air temperature is above seventy-five degrees. Hence, in those countries which have extreme heat combined with humidity, the *Stegomyia callopus* mosquito abounds, and yellow fever is restricted to those localities.

That yellow fever is conveyed by mosquitoes was first asserted in 1881 by Dr. Finlay of Havana. Searching investigations and experiments of a special United States Army Board, in 1890 and later, served to confirm this view. Formerly it was held that filth favored the occurrence of yellow fever, but now it is believed that bad drainage and accumulations of liquid filth are only contributory conditions, because they favor the breeding of the *Stegomyia callopus* mosquito.

It is interesting as well as useful to know something of the habits of mosquitoes. These blood-sucking insects breed in stagnant water, in wet marshes or in any pool or permanent water accumulation, such as may be found in badly graded irrigation ditches, or in roof gutters holding water. And they are especially fond of laying eggs in stagnant pools covered on the surface with a green scum. The larvæ and pupæ which develop from the eggs in a few days, live only in water. Standing water of any kind is therefore the necessary condition for the multiplication of mosquitoes.

As a rule, the fully developed mosquito flies only for short distances, and the *anopheles* and inland mosquitoes in particular are said not to travel very far, but the salt water or marsh mosquito is different in this respect,

for it is a migratory insect and sometimes flies long distances. Mosquitoes dislike sunlight and prefer darkness; they are fond of entering houses, and of hiding in dark rooms, or in dark and damp corners. They sometimes come in swarms and largely so at night time, when they are attracted indoors by the burning lights. They bite chiefly at night, though some species bite also in day time. Mosquitoes often hibernate in the cellars of houses, whence they emerge in the spring to lay their eggs.

The question may occur to some readers, why the farmer should be concerned in the movement for getting rid of mosquitoes. The answer is not far to seek. Mosquitoes are not merely a constant menace to our comfort, but some species may prove a serious danger to our health; they certainly interfere greatly with the comfort of all people living in rural districts, and what is perhaps of more importance, they may affect their business interests. Dr. L. O. Howard of the United States Bureau of Entomology in Washington, asserts that there are instances on record where the attacks of herds of cattle by swarms of mosquitoes reduced the yield of milk to such an extent as to render the keeping of these animals for dairy purposes unprofitable. Horses likewise are injured by the attacks of mosquitoes. But, more than this, there are vast tracts of land in different sections of this country which are rendered practically uninhabitable and impossible of development owing to the presence of mosquitoes in large numbers. It is a matter of record that many places badly infested with them have shown a considerable depreciation in their property value.

Numerous species of mosquitoes are merely, so far as is now known, a source of annoyance by their bite, but do not transmit disease. It is obvious, however, that for practical purposes it is neither necessary nor feasible to distinguish between the different kinds of mosquitoes, and it would also be useless to wage the war of extermination on only one or two kinds. Let us accordingly adopt the much more common sense view that *all* mosquitoes are harmful in one way or another, and let us see what practical measures can be adopted to reduce the nuisance. That it is perfectly feasible to do this has been practically demonstrated in several places, as for instance on Staten Island, N. Y., and on the north shore and in some places on the southern or ocean side of Long Island. In other countries, too, some regions formerly almost uninhabitable on account of mosquitoes have been made salubrious and attractive. By proper measures systematically carried out in the Island of Cuba since 1901, yellow fever and mosquitoes have both been practically wiped out, and similar good work has been accomplished more recently in the Panama Canal zone by "mosquito brigades," organized under the direction of Colonel Gorgas. On the Isthmus yellow fever has been eliminated to a large extent, and malarial fever greatly reduced, and thus this once notoriously unhealthful region has been changed to one fit to live in.

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It has already been pointed out that malaria, like typhoid fever, is chiefly a disease of the country, and this is readily explained by the fact

that there are numerous conditions in farming and rural districts which favor the existence of mosquitoes. Near and about farmhouses there are almost always collections of standing water, or water-filled receptacles which form ideal breeding places. Even small depressions in grass land, small puddles of water, due to cow tracks or to the hoof prints of horses, may become contributing causes of the nuisance. The back yard of a farmhouse offers likewise numerous opportunities for the pests to breed.

Mosquito Control and Extermination.

Farmers can aid in the extermination of the mosquito in two ways: first, by individual efforts, and second, by combined or community efforts. The individual efforts may be either preventive or else protective measures, and it is to the former that we desire to draw particular attention, though the latter will also be referred to briefly.

The most important individual *preventive* measure is the abolishment of all breeding places of mosquitoes. This, of course, requires, first of all, a thorough search for these places, and when they are found, the correct method of proceeding, the only one promising real results, is the permanent destruction, and not merely the temporary treatment, of the breeding places. This was pointed out by Dr. Alva H. Doty in his successful mosquito campaign on Staten Island, N. Y., and likewise by Dr. John B. Smith, state entomologist of New Jersey, in his efforts to rid parts of that state of mosquitoes. Many breeding places are the direct result of untidiness and carelessness, and are readily abolished.

The simple and practical measures to be adopted consist in (1) drainage; (2) filling in; (3) treatment with kerosene oil or similar preparations. Rank growths of weeds or high grass on the banks of sluggish streams, and weed-protected shallow nooks of ponds, often conceal some breeding puddles, and in themselves form favorite harboring places for the adult mosquito. Hence, the farmer should keep his lawns well trimmed and do away with all weeds, high grass and low bushes or shrubs about ditches, brooks and ponds. Back yards and vacant lots should be cleaned up and put in a tidy condition. Among numerous places which collect rain water and where mosquitoes will breed by preference, should be mentioned ill-drained roadside ditches and road gutters, catch basins, undrained bog holes, all places where the natural drainage has been interfered with, swamps or marshy places, depressions or pools in rocky ledges, newly made and water-filled hollows and excavations generally; holes formed by the pulling out of tree stumps, also holes in decaying trunks of trees, as well as ill-graded irrigation ditches.

All such danger spots should be abolished by draining them properly, or where this is only partly practicable, by supplementing the drainage work with judiciously applied and permanent filling-in. In doing this one should be extremely watchful not to create new breeding places.

Places about the farmhouse where mosquito larvæ or wigglers may usually be found are all kinds of water-containing receptacles, such as the following; old tin cans on the garbage pile, old tubs, pails or buckets and

watering pots, garden or house vases, broken crockery and glassware, water troughs, ornamental water gardens and pools containing stagnant water. The farmer should therefore strive not to leave any kind of receptacle lying about in which rain water may accumulate. A single tin can or an earthen jar with standing water may breed scores of mosquitoes. The roof gutters should not be overlooked in the inspection, for if they are not properly pitched, or have sagged at a point away from the outlet, or if obstructed at the connection with the leader, they will hold stagnant water, which will attract the female mosquito.

All receptacles in or about a house holding water should be either removed, emptied or screened. Roof tanks, rain-water barrels, underground cisterns, sewage tanks and cesspools, also drainage catchbasins of all kinds are often found to be breeding places, and hence they should be covered and protected with wire or cotton gauze screens. Cisterns may also be treated with oil or kerosene. The water in watering troughs, and that placed in chicken coops and dog kennels, should be changed daily.

Wet places and pools which can neither be permanently drained nor filled in may be treated by pouring or spraying over them some common kerosene oil. The oil interferes with the breathing of the larvæ, and thus suffocates them. The odor of the oil is also abhorred by the fully developed mosquito. This method of treatment applies of course only to still water, and would be inefficient for running brooks. The oil is a good protection while it lasts. The drawback is that it is apt to evaporate rather rapidly, and that it disappears quickly after rain storms, and hence the application should be renewed every week or two, which renders this remedy both irksome and expensive. The oil is spread in a thin film over the water surface, and one ounce suffices for from fifteen to twenty square feet. The treatment of cisterns and of cesspools with kerosene oil is also advisable.

The treatment of standing water with crude petroleum oil has been found to have other drawbacks. It is difficult to spread the oil evenly, and the wind blowing over the water is apt to drive the oil to certain spots, leaving other parts of the water surface free from it. A better method than the spraying of the surface consists in injecting the oil at a greater depth.

Instead of crude oil, a chemical preparation known as phinotas oil (made by the Phinotas Chemical Company of 237 Front Street, New York City) has been successfully used in recent years, and found to be an efficient and rapidly acting preparation for killing the mosquito larvæ. This oil is prepared from crude petroleum, but differs from it in having the property of sinking to the bottom at first and subsequently rising to the surface. The small globules of this oil, after breaking, diffuse themselves over a large area. In some cases it has been distributed by means of a pressure or force pump, operated by hand. Experiments made in New Jersey with this liquid have shown that the treatment need not be applied oftener than once every four weeks, hence it requires less labor, and thus becomes a cheaper remedy than the application of kerosene oil. The phinotas oil is also said to be useful in the treatment of cesspools.

Another measure which has proved effective in many cases is to stock the ponds or pools with small fishes, such as minnows, sun fish and gold fish. These eat the larvæ and eggs of the mosquito. To render this remedy successful, it is necessary to dig out and deepen all shallow edges of ponds, and to trim the vegetation along their margin, in order that the fish may reach the breeding places.

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The farmer should also apply measures for the extermination of mosquitoes within his house and barn. If a careful search shows the rooms, the cellar or the barn to harbor mosquitoes, the insects may be driven out or done away with by burning pyrethrum or insect powder, the fumes from which stupefy them. They should then be swept up and burned in the range. A mixture of equal weight of gum camphor and pure carbolic acid in crystal form may be evaporated in the rooms, in the proportion of three ounces to 1000 cubic feet, but the liquid is inflammable and the fumes are poisonous, hence great care should be exercised in applying the remedy. Another remedy consists in spreading oil of pennyroyal on a blotting paper, which is placed either on the window sills or about the room, or on the bed pillows in the case of bedrooms; spirits of lavender, used on a handkerchief, are also said to drive mosquitoes away. Tobacco fumes and lighted Chinese punk sticks may be helpful in this respect, and the use of naphthaline or moth balls also repels the insects.

A careful search should be made in the cellar for any hibernating mosquitoes. Fumigation with sulphur or with formaldehyde should be resorted to in order to clear the cellar; if there are any drain openings, or floor cesspools, these should be freely sprinkled with kerosene oil.

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The *protective* measures against mosquitoes are perhaps fully as important as the preventive measures spoken of thus far. In order not to attract the insects at night, it is advisable not to use a bright light in bedrooms when retiring. One should always avoid sitting outdoors at night in mosquito-infected districts, in order not to expose oneself to the bite of the malaria-carrying insect. One of the best preventives against mosquito bites is the use of oil of citronella, diluted in olive oil.

Windows and outside doors of farmhouses should be carefully screened to keep out the mosquitoes. The screens may be either metallic or consist of the cheaper gauze or cotton netting, and the screen doors should preferably have self-closing spring attachments. Beds may be protected with mosquito netting or canopies. The proper screening of farmhouses is a very important measure of protection; hence it is desirable to know where to obtain satisfactory screens. Well-known screens are those made in wooden frames by E. P. Burrowes of Portland, Maine, and the metal-frame screens manufactured by the Higgins Manufacturing Company of 1133 Broadway, New York City. The screens of both firms are excellent, but rather high priced.

Other screen manufacturers are the Cincinnati Manufacturing Company, the Watson Screen Company, Jamestown, N. Y., and the Roebuck Wire Screen Company of Brooklyn.

The Invisible Roll Screen Company of East Avenue, Long Island City, N. Y., makes a novel rolling screen, consisting of an all-metal frame, to which rustless wire cloth is attached. It rolls up like a shade and is said not to get out of order easily. When the window is opened, the screen can be rolled up with the sash, and when it is closed, it rolls out of sight. A somewhat similar device is the Jamestown rolling screen, sold by Carroll, Entwistle & Company, 1261 Broadway, New York City. This is fastened both to the window sill and to the sash, and when the window is raised the screen unrolls. The screen is fastened to a patented roller, which is attached to the sill, and when not raised it remains concealed in a light metal box. The screen does not consist of metal wire, but is made of a specially woven fibrous mesh.

Even the less prosperous farmer can protect his windows with home-made screens of cotton gauze, and he will be amply repaid for the relatively trifling expenditure by the increased working capacity obtained from an undisturbed sleep. Many farmers are not sufficiently informed about, and hence not ready to appreciate, the importance of keeping the insect pests out of a house, hence this form of protection against both flies and mosquitoes should be encouraged by experiment stations and by boards of health as a sanitary measure.

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Much more effective work in mosquito extermination can be accomplished by the *combined efforts of farmer communities,* and this applies in particular to the salt-marsh mosquito. The wide-awake farmer, who is bent upon securing good results, requires the intelligent coöperation and cheerfully rendered assistance of his neighbors. With this in view, he should endeavor to persuade the owners of neighboring farms to follow his own example in carrying out the individual efforts described heretofore. In farm villages, improvement societies should be formed, one of their objects being the organized war against the mosquito pest. The work of such a society should be laid out and directed by one responsible head, and it is desirable that he be a practical sanitarian. Much of the work to be done is of an engineering nature, such as the ditching of marshes, the proper grading of gutters, etc.; hence the assistance of an engineer familiar with drainage work is much to be desired. A beginning in the work should be made by calling upon each farmer member of the society to make individual efforts about his own premises to get rid of the mosquitoes. Once a week each member should make a thorough inspection of his entire premises with a view of finding neglected spots which might form breeding places, and also with a view to enforcing cleanliness and tidiness.

Each member should, of course, be required to carry out on his premises the individual efforts recommended heretofore. After that should come the coöperative efforts, comprising chiefly measures directed

against the eggs and larvæ of the insects, for the destruction of these materially assist in reducing the number of mosquitoes. To accomplish effective results, a general map should be prepared, on which the principal breeding places and places infested with mosquitoes should be clearly shown, such as old mill ponds, swamps, all large water pools, sluggish streams, and salt-marsh areas. Once this map is available, a comprehensive plan of campaign can be laid out.

The coöperative work recommended comprises the drainage of marshes [redacted]

ADDENDUM.

We still lack authoritative knowledge regarding some treatment of the horse manure , which while retaining, or perhaps even enhancing, its manurial value, would efficiently prevent the breeding of the flies.

We must look to the U. S. Dept. of Agriculture to make exhaustive experiments, or to the State Agricultural Experiment Stations to take up this burning question.

Since the summer of 1913, the Bureau of Entomology, working in co-operation with the Bureaus of Chemistry and of Plant Industry in Washington, have begun working on this problem, and their experiments are going to be continued during the winter months at the New Orleans Experiment Station of the Department of Agriculture.

No definite conclusions have so far been reported, but it is hoped that the Department will soon be in a position to publish some useful information, chiefly as to what chemicals should be added to horse manure to not only eliminate the fly larvae, but at the same time to increase the value of the manure to the farmers.

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